

Reusable Nanocomposite Membranes for the Selective Recovery of Nutrients in Space, Phase I

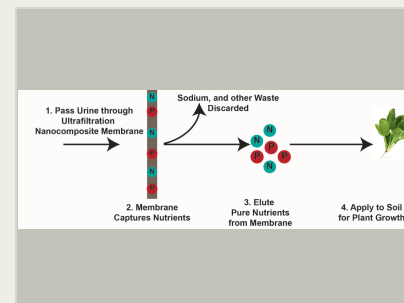
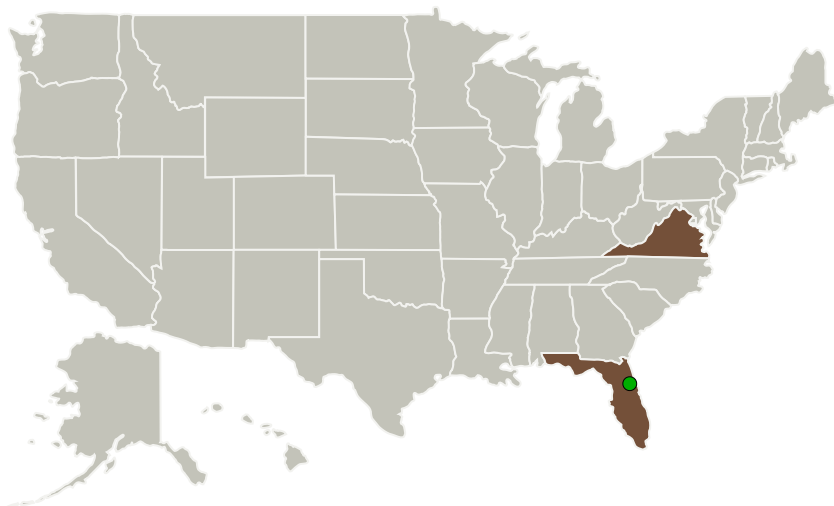
Completed Technology Project (2017 - 2018)



Project Introduction

Through the STTR program, NanoSonic and Virginia Tech will create low-cost, reusable membranes that selectively capture and recycle nutrients (e.g., N, P, K) from urine in space. Urine is a readily available commodity in space that is rich in valuable nutrients for plant growth. Humans produce individually about 500 L of urine per year that contains ~7 g/L of nitrogen (N), ~1 g/L phosphorous (P), and ~2 g/L potassium (K). NanoSonic shall fabricate tailored nanocomposite ultrafiltration membranes that selectively capture key nutrients from urine through tailored binding chemistries, while filtering away undesirable components including sodium. The nutrients will then be eluted from the membrane and available in a useful form for direct application on plant soil. NanoSonic's membranes have excellent chemical and mechanical properties allowing for repeated use over long time periods, thereby limiting the need for replacement. Moreover, their high thermal transition temperature (~190C) permits serviceability in space where the temperature can range from ~-150C to +120C. Our STTR partners, Professors He and Vikesland in Civil and Environmental Engineering at Virginia Tech, are experts in nutrient recovery and the use of nanotechnology for wastewater treatment. During Phase I, together with Virginia Tech, NanoSonic will increase the Technology Readiness Level (TRL) from 3 to 5 of our simple, lightweight, and low-cost filtration membranes through membrane analyses. TRL 7 shall be achieved during Phase II with industry support from our Environmental Engineering partners at 3e for nutrient extraction from urine to be deployed for plant growth in space on board the International Space Station (ISS).

Primary U.S. Work Locations and Key Partners



Reusable Nanocomposite Membranes for the Selective Recovery of Nutrients in Space, Phase I Briefing Chart Image

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

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Organizations Performing Work	Role	Type	Location
Nanosonic, Inc.	Lead Organization	Industry	Pembroke, Virginia
● Kennedy Space Center(KSC)	Supporting Organization	NASA Center	Kennedy Space Center, Florida
Virginia Polytechnic Institute and State University(VA Tech)	Supporting Organization	Academia	Blacksburg, Virginia

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Nanosonic, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

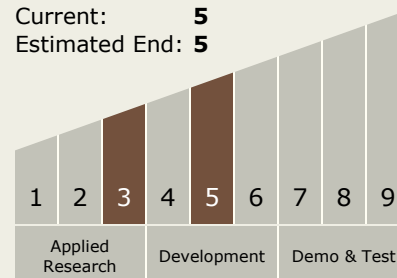
Carlos Torrez

Principal Investigator:

Jennifer Lalli

Technology Maturity (TRL)

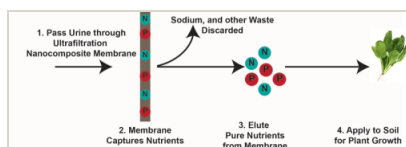
Start: **3**
 Current: **5**
 Estimated End: **5**



Primary U.S. Work Locations

Florida	Virginia
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Images



Briefing Chart Image

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 (<https://techport.nasa.gov/image/133656>)

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Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - └ TX07.2 Mission Infrastructure, Sustainability, and Supportability
 - └ TX07.2.1 Logistics Management

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System